

tric, hydraulic, and pneumatic power transmission. Students of geography and history are provided with an abundance of material, including the latest statistics referring to the chief countries of the world the names of which fall alphabetically between Natal and Portugal, besides an elaborate account of the polar regions, and an able review of the present state of our knowledge of oceanography. Mathematicians will find the article on "Number" both interesting and original, and readers who prefer biographical studies will meet with appreciative estimates of the lives of such celebrities as Owen, Paget, and Pasteur, to name only three.

But no mere mention of a few of the contents can serve more than to give a vague idea of the variety of valuable material brought together in this volume, and the space available makes it possible to refer only to a few of the chief contributions.

The prefatory essay of this volume—and it must be remembered that these essays are a distinguishing characteristic of this new edition—is by Mr. Frederick Greenwood, and deals with the influence of commerce on international conflict. In this scholarly presentation of an important problem, Mr. Greenwood shows how the growth of commerce has given rise in recent times to dreams of the extinction of war. He goes on to explain, however, how war became later to be regarded as a trade weapon and an instrument for the provision of new markets; and as the discoveries of men of science have placed resources for the destruction of men at the disposal of the armies of the world so terrible in their efficiency that, to ensure any chance of success in a war between great Powers, each of them must have armies so large and so expensively equipped as to lead to a growing likelihood of war becoming so dreadful and so costly that it would not be endured. Yet notwithstanding the horror and brevity of modern battles, humanity still seems able to bear the excess, and militarism flourishes.

Of another factor influencing the industrial competition of the nations Mr. Greenwood takes no notice, and that is the increased attention being paid by the leading nations to the higher education of their manufacturers and merchants. The combined efforts of armies and nations are not enough to secure commercial supremacy. A nation must, in addition, provide a sufficient number of institutions of higher education to secure opportunities for its citizens to become conversant with modern scientific knowledge, able to apply the principles of science to modern industrial problems, and to extend the bounds of science into the unknown. The volume itself does not, we find, ignore the importance of higher technical education, for in addition to articles with a less direct bearing on the subject, an essay on polytechnics by Sir Joshua Fitch is included. The subject does not appear to have been allotted the amount of space its importance merited, and the consequence is that metropolitan polytechnics are alone described. It is a pity that the opportunity could not have been taken to familiarise British readers with the complete and lavish provision of institutions abroad corresponding to these polytechnics. The comparison to which such an article must have given rise

would have shown England's lamentable deficiency and the low position she must be assigned when the sacrifices made by the leading peoples for the establishment of institutions of the higher learning are passed in review.

BIO-CHEMISTRY.

The Chemical Changes and Products Resulting from Fermentations. By R. H. Aders Plimmer. Pp. vi + 184. (London: Longmans and Co., 1903.) Price 6s. net.

THE number of chemists who are interested in biological problems is now gradually on the increase, whilst, on the other hand, the biologist realises the importance of a further investigation of the chemical changes concomitant with life. In these circumstances, the book of Dr. Aders Plimmer cannot fail to be particularly welcome, and the perusal of this admirable *résumé* of the work in the borderland between biology and chemistry will indicate to the reader how much has been done and how much still remains to be done in this most difficult field of research.

Under his treatment of polysaccharides the author gives a succinct account of the chemistry of starch, and then proceeds to discuss the changes undergone by monosaccharides and glucosides. In this connection due prominence is given to the recent important observations of Croft Hill, Emmerling and E. Fischer and E. F. Armstrong on reversible ferment action. In the chapter on changes in esters reference is made to the work on lipase, where Kastle concludes that ferments do not act on substances which can be electrolytically dissociated. It should be noted, however, that Slimmer has subsequently pointed out that this view cannot be maintained, since glucovanillic acid and other electrolytes are attacked by emulsin. Other chapters include changes in urea and uric acid, blood, albumins, and changes occurring as a result of oxidation and reduction. Nitrification and denitrification are also considered, and the volume is completed by an account of the changes occurring as the result of putrefaction.

It is pointed out in connection with lactic acid production by microorganisms that the usual product is the inactive acid, but that one of the pure optically active forms may sometimes be obtained. In this latter case the author is apparently of the view that the inactive acid is first of all formed and then converted into the one active form by the selective action of the organism. Experimental evidence, however, seems to show that, if the action were of this nature, the resulting product would not be the pure active acid but rather a mixture of inactive and active acids. Frankland's resolution of *i*-glyceric acid, where the one active constituent is attacked by *Bacillus ethaceticus* and the other apparently remains untouched, is altogether exceptional. In those cases, however, where the lactic acid obtained is optically active, but is mixed with some of the inactive form (as in Harden's experiments on the action of *Bacillus coli communis* on *d*-glucose, &c.), the possibility of the intermediate

formation and subsequent partial resolution of inactive acid may be maintained. In the discussion of Harden's results (p. 69), it is not clear why the lactic acid formed should be optically active at all; from the description given it appears that the asymmetry of the molecule must disappear altogether.

Dr. Plimmer points out that many of the changes caused by living organisms may possibly be due to enzyme action. In addition to his experiments with zymase, Buchner has lately submitted further experimental evidence in favour of this conception, since, conjointly with Meisenheimer, he has proved that from *Bacillus acidificans longissimus* an enzyme may be prepared which converts cane sugar into lactic acid. The same investigators have also shown that the conversion of ethyl alcohol into acetic acid may be accomplished by an enzyme which they obtained from vinegar bacteria.

Buchner's work on zymase surely merits more than the few lines which the author devotes to it, especially since space is found for an account of many discoveries which are of much less fundamental importance. Reference might also have been made to Bredig's experiments on inorganic ferments. Further, one cannot help regretting that a brief account of Emil Fischer's work on the decomposition products of albuminoids is not incorporated in the volume. Those are, however, minor objections. British workers in different sciences will appreciate Dr. Plimmer's account of biochemistry.

A. McK.

OUR BOOK SHELF.

Metallurgical Laboratory Notes. By Henry M. Howe, Professor of Metallurgy in Columbia University. Pp. xiv+140. (Boston: The Boston Testing Laboratories, 1902.)

The time has passed when practical teaching in metallurgy was a synonym for little more than a course of exercises in assaying. No one recognised this sooner and more fully than Prof. Howe, and his students now devote much of their time in the laboratory to carrying out experiments illustrating the principles which underlie the various processes of the treatment of ores and metals in works. This little volume contains a description of ninety-one such experiments of both educational and instructive value, and constitutes the first attempt to embody the new methods in book form. The author expresses in the preface his feeling that the series of experiments now published is incomplete and shows a lack of balance, and probably many metallurgists will find themselves constrained to agree with him. Those teachers who are convinced that ore treatment is still by far the most important branch of the subject may object to a system in which the majority of the experiments are directed to the study of the treatment and properties of metals. Even the methods will not command universal approval in this country, where students are encouraged to learn to overcome the difficulties occasioned by the use of indifferent implements on the grounds that they will be better fitted by such training to deal with the more serious difficulties unavoidably encountered in the industries. The smoothing away of obstacles, and the reduction to a minimum of the practice in manipulation, have been characterised as "spoonmeat methods." It must

be admitted, however, that these views are likely to be held most firmly by the professors who are least adequately supplied with laboratory equipment. Prof. Howe considers that in proportion as less time is devoted to details of manipulation, more leisure is available to the student for "the unwelcome task of thinking," than which nothing could be more important. Perhaps it might be argued that practice in manipulation would make the best laboratory workers, and that practice in thinking would assist in turning out the best general managers. The book is extremely welcome, and breaks ground that must soon be assiduously cultivated. It will be carefully studied by all who have the improvement in the training of metallurgists at heart.

T. K. R.

Nature Studies in Australia. By W. Gillies and R. Hall. Pp. v+299. (Melbourne and London: Windcombe and Tombs, Ltd., n.d.) Price 2s.

THE recognition of the importance of "nature-study," if we are to know anything really worth knowing about animals and plants, in Australia is a satisfactory sign of the times, and an indication that throughout the world the old-fashioned ways of teaching are to be abolished, and also that the days of mere section-cutting and skin-describing are numbered. The greater part of the present little volume is devoted to birds (mammals being left out), of the life-histories of which Mr. R. Hall has for many years been an enthusiastic student, and we must congratulate both authors on the mass of interesting information they have concentrated into such a small space with regard to a number of characteristic Australian species. The majority of the numerous illustrations are the results of the authors' own cameras, and, although necessarily on a small scale, they are, for the most part, excellent examples of bird-photography. One great advantage possessed by the authors is that their subject has a freshness which cannot be claimed for descriptions of British bird-life, and this gives a charm to their work which stay-at-home writers must find it difficult to equal. We must confess, however, to a feeling of dissatisfaction at the use of names like "lunulated honey-eaters" for certain of the species, which are certainly not examples of "nature-teaching," and we are by no means sure that we quite like the "pupil and teacher" style on which the work is planned—it savours a little too much of "Sandford and Merton."

One fact appears of more than usual interest. It is commonly stated in ornithological works that every species of migratory bird breeds in the most northern portion of its range. According, however, to the authors, at least one Australian bird—the double-banded or sand dotterel—goes south to breed, travelling to the south of New Zealand, "that is to say, as far towards Antarctica as it can now get."

Space, we regret to say, prevents our going deeper into the contents of the work before us, the latter portion of which is devoted to the lower vertebrates and invertebrates. We can, however, safely recommend it to the best attention of teachers of nature-study, if only for the fact that a book written on the spot is worth a dozen compilations made elsewhere. The price renders it within the reach of all. R. L.

Considerazioni agrarie sul Piano di Capitanata. By Dr. Nestore Petrilli. Pp. 87. (Naples, 1902.)

THIS work consists of a monograph upon the agricultural conditions which prevail in the great plain of the Capitanata, constituting the northern part of Apulia. Such monographs, which are regularly produced upon the Continent, and provide great assist-